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PATENT & TRADEMARK OFFICE

Docket No.: 061352-0056 **PATENT**

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of	:	Customer Number: 20277
Nobuyuki OTSUKA, et al.	:	Confirmation Number: 1697
Application No.: 10/718,581 Patent No.: 7,009,216 B2	:	Group Art Unit: 2815
Filed: November 24, 2003 Issued: March 7, 2006	:	Examiner: Jerome JACKSON JR.

For: SEMICONDUCTOR LIGHT EMITTING DEVICE AND METHOD OF FABRICATING THE SAME

REQUEST FOR CERTIFICATE OF CORRECTION UNDER 37 CFR 1.322

Certificate
AUG 1 5 2006
of Correction

Mail Stop **Certificate of Correction**
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

In reviewing the above-identified patent, a printing error was discovered therein requiring correction in order to conform the Official Record in the application.

The error noted is set forth on the attached copy of form PTO-1050 Rev. 2-93 in the manner required by the Commissioner's Notice.

Specifically, in printed Claim 1, Column 21, line 52, the word "overlays" should read -- **overlaps** - -. In addition, in printed Claim 18, Column 23, line 23, the word "overlay" should read - - **overlap** --. A copy of the amendment filed September 8, 2005 containing the associated text showing the correct words is enclosed for your information and convenience.

AUG 15 2006

10/718,581
7,009,216

The change requested herein occurred as a result of printing the Letters Patent and the Certificate should be issued without expense under Rule 322 of the Rules of Practice. Accordingly, Applicants request issuance of the Certificate of Correction.

Please charge any shortage in fees due in connection with the filing of this paper to Deposit Account 500417 and please credit any excess fees to such deposit account.

Respectfully submitted,

MCDERMOTT, WILL & EMERY LLP

Michael E. Fogarty
Registration No. 36,139

Please recognize our Customer No. 20277 as our correspondence address.

600 13th Street, N.W.
Washington, DC 20005-3096
Phone: 202.756.8000 MEF:bd
Facsimile: 202.756.8087
Date: August ~~10~~, 2006
11 BD

WDC99 1269154-1.061352.0056

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UNITED STATES PATENT AND TRADEMARK OFFICE

CERTIFICATE OF CORRECTION

PATENT NO. : 7,009,216 B2

DATED : March 07, 2006

INVENTOR(S) : Nobuyuki OTSUKA, et al.

It is certified that an error appears in the above-identified patent and that said Letters Patent is hereby corrected as shown below:

IN THE CLAIMS:

Claim 1, Column 21, line 52, change "overlays" with -- overlaps --;

Claim 18, Column 23, line 23, change "overlay" with – overlap --.

AUG 15 2006

WDC99 1269129-1.061352.0056

McDermott Will & Emery

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E-Mail:	rfarid@mwe.com	*Direct Fax:*	202.756.8087
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Re: **Application No.: 10/718,581**

Message:

Amendment in response to Office Action dated June 8, 2005.

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WDC99 1131443-1.061352.0056

****
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Re: **Application No.: 10/718,581**

Message:

Amendment in response to Office Action dated June 8, 2005.

AUG 15 2006

ORIGINAL COPY

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E-Mail:	[redacted]		202.756.8087
Sent By:	Matilda Newman	Direct Phone:	202-756-8661
Client/Matter/Tkpr:	61352-056/5328	Original to Follow by Mail:	No
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PAGE 1/15 * RCVD AT 9/8/2005 8:51:51 PM [Eastern Daylight Time] * SVR:USPTO-EFXRF-6/25 * DNIS:2738300 * CSID:202 756 8087 * DURATION (mm-ss):03-18

AUG 15 2006

Docket No.: 061352-0056 **PATENT**

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of	:	Customer Number: 20277
Nobuyuki OTSUKA, et al.	:	Confirmation Number: 1697
Application No.: 10/718,581	:	Group Art Unit: 2815
Filed: November 24, 2003	:	Examiner: Jerome JACKSON JR.

For: SEMICONDUCTOR LIGHT EMITTING DEVICE AND METHOD OF FABRICATING THE SAME

Mail Stop Amendment
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Dear Sir:

Transmitted herewith is an Amendment in the above-identified application.

☐ No additional fee is required.
☐ Applicant is entitled to small entity status under 37 CFR 1.27
☐ Also attached:

The fee has been calculated as shown below:

	NO. OF CLAIMS	HIGHEST PREVIOUSLY PAID FOR	EXTRA CLAIMS	RATE	FEE
Total Claims	23	20	3	$50.00 =	$150.00
Independent Claims	3	3	0	$200.00 =	$0.00
		Multiple dependent claims newly presented			$0.00
		Fee for extension of time			$0.00
					$0.00
		Total of Above Calculations			$150.00

☒ Please charge my Deposit Account No. 500417 in the amount of $150.00.

☒ The Commissioner is hereby authorized to charge payment of any fees associated with this communication or credit any overpayment, to Deposit Account No. 500417, including any filing fees under 37 CFR 1.16 for presentation of extra claims and any patent application processing fees under 37 CFR 1.17.

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I hereby certify that this paper is being facsimile transmitted to the Patent and Trademark Office on the date shown below.

Ramyar M. Farid
Type or print name of person signing certification

Signature 9/8/2005
Date

Respectfully submitted,

McDERMOTT WILL & EMERY LLP

Ramyar M. Farid
Registration No. 46,692

600 13th Street, N.W.
Washington, DC 20005-3096
Phone: 202.756.8000 RMF:men
Facsimile: 202.756.8087
Date: September 8, 2005

Please recognize our Customer No. 20277 as our correspondence address.

Docket No.: 061352-0056 **PATENT**

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Filed: November 24, 2003	:	Examiner: Jerome JACKSON JR.

For: SEMICONDUCTOR LIGHT EMITTING DEVICE AND METHOD OF FABRICATING THE SAME

AMENDMENT

Mail Stop Amendment
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

In response to the Office Action dated June 8, 2005, having a shortened statutory period for response set to expire September 8, 2005, please amend the above-identified application as follows:

IN THE CLAIMS

Please amend the claims as follows:

1. (Currently amended) A semiconductor light emitting device comprising:

a semiconductor substrate;

a semiconductor layered structure provided on the semiconductor substrate and comprised of a lower cladding layer made of semiconductor of a first conductivity type, an active layer having a resonator in a direction parallel to the semiconductor substrate, and an upper cladding layer made of semiconductor of a second conductivity type;

an upper electrode connected to the upper cladding layer and extending in a stripe shape in a resonator direction; and

a lower electrode connected to the lower cladding layer, wherein

the semiconductor layered structure has a photonic crystal structure on a front surface thereof in which a plurality of concave portions or convex portions are arranged periodically in the resonator direction,

the photonic crystal structure is configured such that at least part of the photonic crystal structure does not overlap with the upper electrode and the photonic crystal structure and the upper electrode are arranged in the resonator direction as seen in a plan view, ~~and~~

when a predetermined voltage is applied between the upper electrode and the lower electrode, ~~light radiates from~~ a hole supplied from the lower electrode through the lower cladding layer and an electron supplied from the upper electrode through the upper cladding layer are re-coupled to each other within the active layer to thereby generate light in a region of the photonic crystal structure which does not overlap with the upper electrode as seen in [[a]] the plan view and a region of the photonic crystal structure which overlaps with the upper electrode as seen in the plan view, and

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<u>the light radiates from the region of the photonic crystal structure which does not overlap with the upper electrode as seen in the plan view in a direction perpendicular to the resonator direction</u>.

2. (Original) The semiconductor light emitting device according to Claim 1, wherein the concave portions or the convex portions are formed in the upper cladding layer.

3. (Original) The semiconductor light emitting device according to Claim 1, wherein the concave portions or the convex portions are formed in the upper cladding layer, the active layer, and the lower cladding layer.

4. (Original) The semiconductor light emitting device according to Claim 1, wherein the concave portions or the convex portions are cylindrical.

5. (Original) The semiconductor light emitting device according to Claim 1, wherein the concave portions or the convex portions are flat-plate shaped.

6. (Original) The semiconductor light emitting device according to Claim 1, wherein the resonator has a width of not less than 2μm and not more than 10μm.

7. (Original) The semiconductor light emitting device according to Claim 1, wherein the resonator has a length of not less than 20μm and not more than 50μm.

8. (Original) The semiconductor light emitting device according to Claim 1, wherein the resonator direction is <110> direction or <-110> direction.

9. (Original) The semiconductor light emitting device according to Claim 1, wherein the concave portions or convex portions are arranged in the shape of rectangular lattice such that one arrangement direction of the concave portions or the convex portions corresponds with the resonator direction and another arrangement direction is perpendicular to the resonator direction.

10. (Original) The semiconductor light emitting device according to Claim 9, wherein a spacing between adjacent concave portions or convex portions in the one arrangement direction is different from a spacing between adjacent concave portions or convex portions in the another arrangement direction.

11. (Original) The semiconductor light emitting device according to Claim 10, wherein the spacing between adjacent concave portions or convex portions in the one arrangement direction is larger than the spacing between adjacent concave portions or convex portions in the another arrangement direction.

12. (Original) The semiconductor light emitting device according to Claim 1, wherein reflection films are provided on both end faces of the semiconductor layered structure.

13. (Original) The semiconductor light emitting device according to Claim 1, wherein the semiconductor layered structure is provided with a photonic crystal structure on a periphery

thereof, and the photonic crystal structure is comprised of a plurality of concave portions or convex portions arranged at a predetermined spacing.

14. (Original) The semiconductor light emitting device according to Claim 1, wherein the concave portions or the convex portions are provided over an entire upper surface of the semiconductor layered structure.

15. (Original) The semiconductor light emitting device according to Claim 14, wherein the region of the photonic crystal structure that does not overlap with the upper electrode as seen in a plan view is located at a center portion of the semiconductor layered structure.

16. (Original) The semiconductor light emitting device according to Claim 1, wherein a spacing between part of the concave portions or convex portions adjacent in the resonator direction is larger than a spacing between another concave portions or convex portions by a wavelength/ (actual refractive index × 4).

17. (Original) The semiconductor light emitting device according to Claim 1, comprising a plurality of semiconductor layered structures, wherein the plurality of semiconductor layered structures are arranged to cross one another.

18. (Currently amended) A method of fabricating a semiconductor light emitting device comprising:

a semiconductor substrate; a semiconductor layered structure provided on the semiconductor substrate and comprised of a lower cladding layer made of semiconductor of a first conductivity type, an active layer having a resonator in a direction parallel to the semiconductor substrate, and an upper cladding layer made of semiconductor of a second conductivity type; an upper electrode connected to the upper cladding layer and extending in a stripe shape in a resonator direction; and a lower electrode connected to the lower cladding layer, the semiconductor layered structure having a photonic crystal structure on a front surface thereof in which a plurality of concave portions or convex portions are arranged periodically in the resonator direction, the photonic crystal structure being configured such that at least part of the photonic crystal structure does not overlap with the upper electrode and the photonic crystal structure and the upper electrode are arranged in the resonator direction as seen in a plan view, wherein when a predetermined voltage is applied between the upper electrode and the lower electrode, a hole supplied from the lower electrode through the lower cladding layer and an electron supplied from the upper electrode through the upper cladding layer are re-coupled to each other within the active layer to thereby generate light in a region of the photonic crystal structure which does not overlap with the upper electrode as seen in the plan view and a region of the photonic crystal structure which overlaps with the upper electrode as seen in the plan view, and the light radiates from the region of the photonic crystal structure which does not overlap with the upper electrode as seen in the plan view in a direction perpendicular to the resonator direction, ~~wherein light radiates in a direction substantially perpendicular to the semiconductor substrate,~~

the method comprising the steps of:

epitaxially growing the semiconductor layered structure on the semiconductor substrate;

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etching the semiconductor layered structure to form [[a]] the photonic crystal structure comprised of [[a]] the plurality of concave portions arranged periodically in [[a]] the resonator direction; and

forming the upper electrode on the upper cladding layer so as to extend in stripe shape in the resonator direction such that the upper electrode does not overlap with at least part of the photonic crystal structure and the upper electrode and the photonic crystal structure are arranged in the resonator direction as seen in [[a]] the plan view.

19. (Currently amended) A method of fabricating a semiconductor light emitting device comprising:

a semiconductor substrate; a semiconductor layered structure provided on the semiconductor substrate and comprised of a lower cladding layer made of semiconductor of a first conductivity type, an active layer having a resonator in a direction parallel to the semiconductor substrate, and an upper cladding layer made of semiconductor of a second conductivity type; an upper electrode connected to the upper cladding layer and extending in a stripe shape in a resonator direction; and a lower electrode connected to the lower cladding layer, the semiconductor layered structure having a photonic crystal structure on a front surface thereof in which a plurality of concave portions or convex portions are arranged periodically in the resonator direction, the photonic crystal structure being configured such that at least part of the photonic crystal structure does not overlap with the upper electrode and the photonic crystal structure and the upper electrode are arranged in the resonator direction as seen in a plan view, wherein when a predetermined voltage is applied between the upper electrode and the lower electrode, a hole supplied from the lower electrode through the lower cladding layer and an

electron supplied from the upper electrode through the upper cladding layer are re-coupled to each other within the active layer to thereby generate light in a region of the photonic crystal structure which does not overlap with the upper electrode as seen in the plan view and a region of the photonic crystal structure which overlaps with the upper electrode as seen in the plan view, and the light radiates from the region of the photonic crystal structure which does not overlap with the upper electrode as seen in the plan view in a direction perpendicular to the resonator direction, ~~wherein light radiates in a direction substantially perpendicular to the semiconductor substrate,~~

the method comprising the steps of:

epitaxially growing the semiconductor layered structure on the semiconductor substrate;

selectively growing crystal on the upper cladding layer of the semiconductor layered structure to form [[a]] the photonic crystal structure comprised of [[a]] the plurality of concave portions arranged periodically in the resonator direction; and

forming the upper electrode on the upper cladding layer so as to extend in stripe shape in the resonator direction such that the upper electrode does not overlap with at least part of the photonic crystal structure and the upper electrode and the photonic crystal structure are arranged in the resonator direction as seen in [[a]] the plan view.

20. (New) The semiconductor light emitting device according to claim 1, wherein a high energy end or a low energy end of a photonic band gap of the photonic crystal structure conforms to an energy of the light generated by re-coupling within the active layer.

21. (New) The semiconductor light emitting device according to claim 20, wherein the high energy end of the photonic band gap of the photonic crystal structure conforms to the energy of the light generated by re-coupling within the active layer.

22. (New) The semiconductor light emitting device according to claim 20, wherein the low energy end of the photonic band gap of the photonic crystal structure conforms to the energy of the light generated by re-coupling within the active layer.

23. (New) The semiconductor light emitting device according to claim 20, wherein the light generated by re-coupling within the active layer is coupled to the photonic band gap, thereby causing the light to super-radiate in the direction perpendicular to the resonator direction.

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REMARKS

Claims 1, 18 and 19 are the sole independent claims and stand rejected under 35 U.S.C. § 102/103 over Moosburger and Lin and combinations thereof. These rejections are respectfully traversed for the following reasons.

A. Moosburger

Each of claims 1, 18 and 19 embodies a semiconductor layered structure which has a photonic crystal structure on a ***front*** surface thereof. In contrast, as shown in Fig. 1, the semiconductor layered structure of Moosburger (one end thereof is expressed as ridge waveguide and the other end thereof is expressed as cleaved mirror) is provided with a photonic crystal structure on a ***side*** surface thereof. Indeed, because Moosburger is expressly designed to provide the photonic crystal structure as a high function mirror on the side surface (ridge waveguide) of the semiconductor layered structure that tends to become rough in cleaving, Moosburger teaches away from providing the photonic crystal structure on the front surface of the semiconductor layered structure having the cladding layers and the active layer.

B. Lin

Each of claims 1, 18 and 19 embodies a hole supplied from the lower electrode through the lower cladding layer and an electron supplied from the upper electrode through the upper cladding layer are re-coupled to each other within the active layer to thereby generate light in a region of the photonic crystal structure which does not overlap with the upper electrode as seen in the plan view and a region of the photonic crystal structure which overlaps with the upper electrode as seen in the plan view. According to one aspect of the present invention, by causing the active layer to function as the active layer in which the hole and the electron are re-coupled to each other to generate light in the specified regions, the light radiates in the direction perpendicular to the resonator direction.

AUG 15 2006

On the other hand, turning to Lin, only an active layer (156) that is located immediately under an upper electrode 184, which is included in a semiconductor layered structure comprising layers 140, 150, and 160, functions as an active layer (e.g., layer within which a hole and an electron are re-coupled to each other to generate light). As indicated by an arrow 190 in Fig. 1 of Lin, a current flows only in regions 154, 156, and 158 that are located immediately under the upper electrode 184, when flowing between electrodes 184 and 182.

This is due to the fact that, as explained in col. 7, line 18 - col. 8 of Lin (and Fig. 4), a region (162) of the upper cladding layer 160 is an insulating layer which results from oxidization and thermal treatment. A region (157) of the active layer 150 is disordered, and does not function as a layer in which a hole and an electron are re-coupled to each other to generate light. The reason why the region that does not overlap with the upper electrode 184 is the insulating layer and is disordered is that photonic crystal structures 132 and 134 function as mirrors (see PBG mirrors in abstract) as expressly set forth by Lin.

In other words, in order to enable the photonic crystal structures 132 and 134 to function as mirrors, no light should be generated immediately under the photonic crystal structures 132 and 134. For this reason, the region (162) is the insulating layer and the region (157) of the active layer 150 is disordered. Accordingly, light leaking from the mirror radiates from the side surface of the semiconductor layered structure as indicated by reference numeral 105.

As anticipation under 35 U.S.C. § 102 requires that each and every element of the claim be disclosed, either expressly or inherently (noting that "inherency may not be established by probabilities or possibilities", *Scaltech Inc. v. Retec/Tetra*, 178 F.3d 1378 (Fed. Cir. 1999)), in a single prior art reference, *Akzo N.V. v. U.S. Int'l Trade Commission*, 808 F.2d 1471 (Fed. Cir.

1986), based on the forgoing, it is submitted that the cited prior art does not anticipate the independent claims, nor any claim dependent thereon. The Examiner is directed to MPEP § 2143.03 under the section entitled "All Claim Limitations Must Be Taught or Suggested", which sets forth the applicable standard for establishing obviousness under § 103:

> To establish *prima facie* obviousness of a claimed invention, all the claim limitations must be taught or suggested by the prior art. (citing *In re Royka*, 180 USPQ 580 (CCPA 1974)).

In the instant case, the pending rejections do not "establish *prima facie* obviousness of [the] claimed invention" as recited in the independent claims because the proposed combinations fail the "all the claim limitations" standard required under § 103.

Under Federal Circuit guidelines, a dependent claim is nonobvious if the independent claim upon which it depends is allowable because all the limitations of the independent claim are contained in the dependent claims, *Hartness International Inc. v. Simplimatic Engineering Co.*, 819 F.2d at 1100, 1108 (Fed. Cir. 1987). Accordingly, as the independent claims are patentable for the reasons set forth above, it is respectfully submitted that all claims dependent thereon are also patentable. In addition, it is respectfully submitted that the dependent claims are patentable based on their own merits by adding novel and non-obvious features to the combination.

Based on the foregoing, it is respectfully submitted that all pending claims are patentable over the cited prior art. Accordingly, it is respectfully requested that the rejections under 35 U.S.C. § 102/103 be withdrawn.

CONCLUSION

Having fully responded to all matters raised in the Office Action, Applicants submit that all claims are in condition for allowance, an indication for which is respectfully solicited. If

AUG 15 2006

there are any outstanding issues that might be resolved by an interview or an Examiner's amendment, the Examiner is requested to call Applicants' attorney at the telephone number shown below.

To the extent necessary, a petition for an extension of time under 37 C.F.R. 1.136 is hereby made. Please charge any shortage in fees due in connection with the filing of this paper, including extension of time fees, to Deposit Account 500417 and please credit any excess fees to such deposit account.

Respectfully submitted,

McDERMOTT WILL & EMERY LLP

Ramyar M. Farid
Registration No. 46,692

600 13th Street, N.W.
Washington, DC 20005-3096
Phone: 202.756.8000 RMF:men
Facsimile: 202.756.8087
Date: September 8, 2005

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